

The background of the entire slide is a composite image of space. On the left, a large, detailed Earth is visible, showing cloud patterns and continents. To its right is a large, cratered Moon. Further to the right is a smaller, reddish planet, likely Mars. A small rocket is shown in the distance, moving from left to right, with a bright blue and white trail behind it. The sky is a deep blue with numerous white stars. In the bottom right corner, there is a dark silhouette of a person's head and shoulders, looking towards the left. The bottom of the image shows a dark, silhouetted horizon line.

EXPLORESpace TECH
TECHNOLOGY DRIVES EXPLORATION

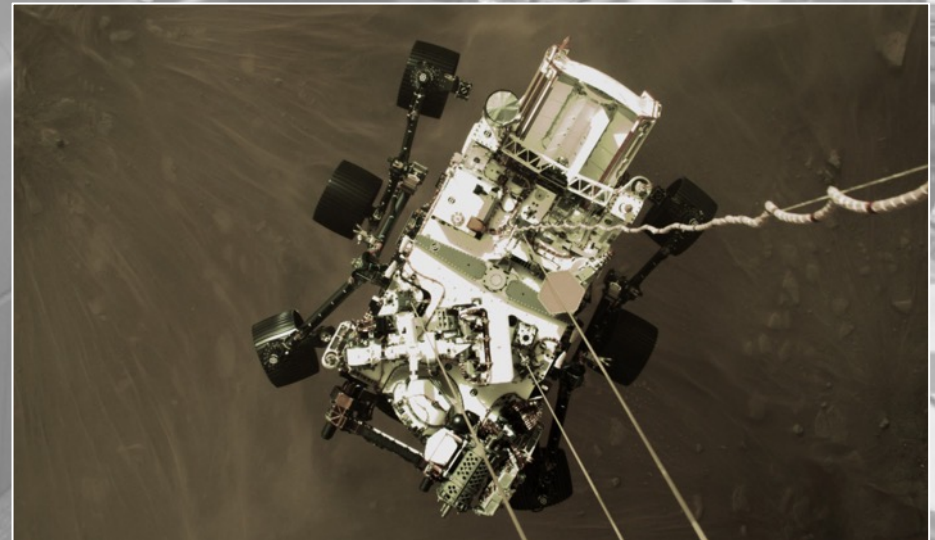
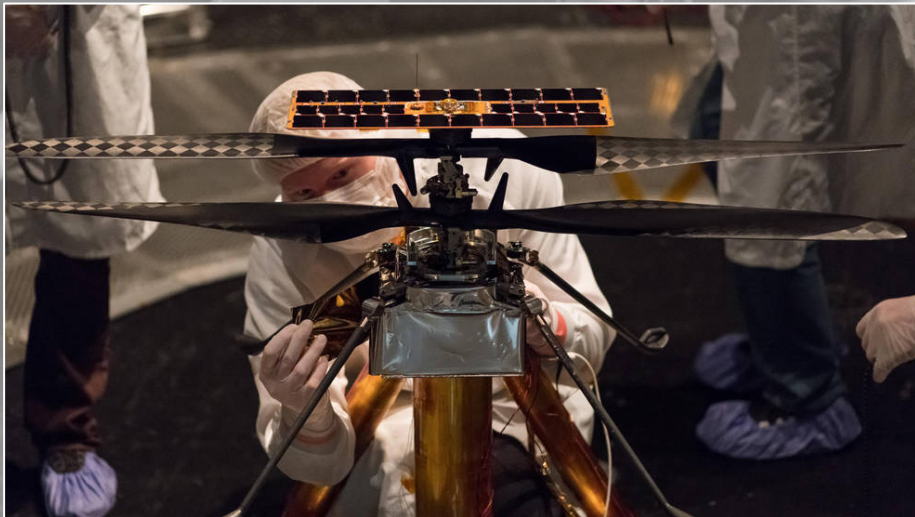
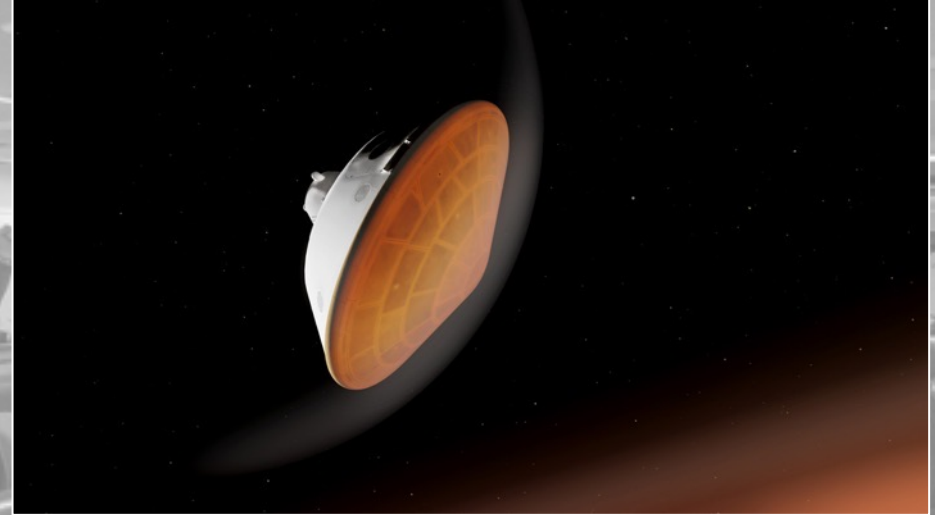
***1st International Conference on Advanced Manufacturing
NASA's Advanced Composites Materials and Manufacturing
Research for the Future***

**John Vickers | Principal Technologist | NASA Space Technology Mission Directorate
March 9, 2022**

Mars 2020 Perseverance Rover & Helicopter Ingenuity

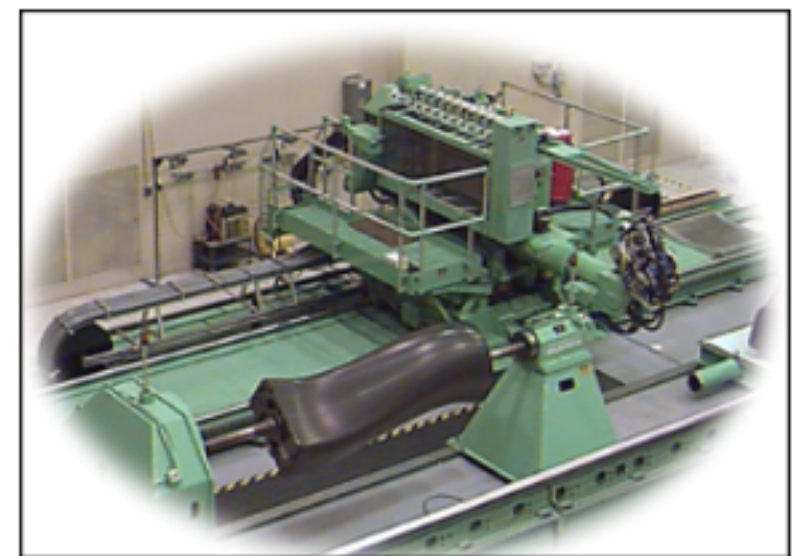


Mars 2020 Perseverance Rover & Helicopter Ingenuity

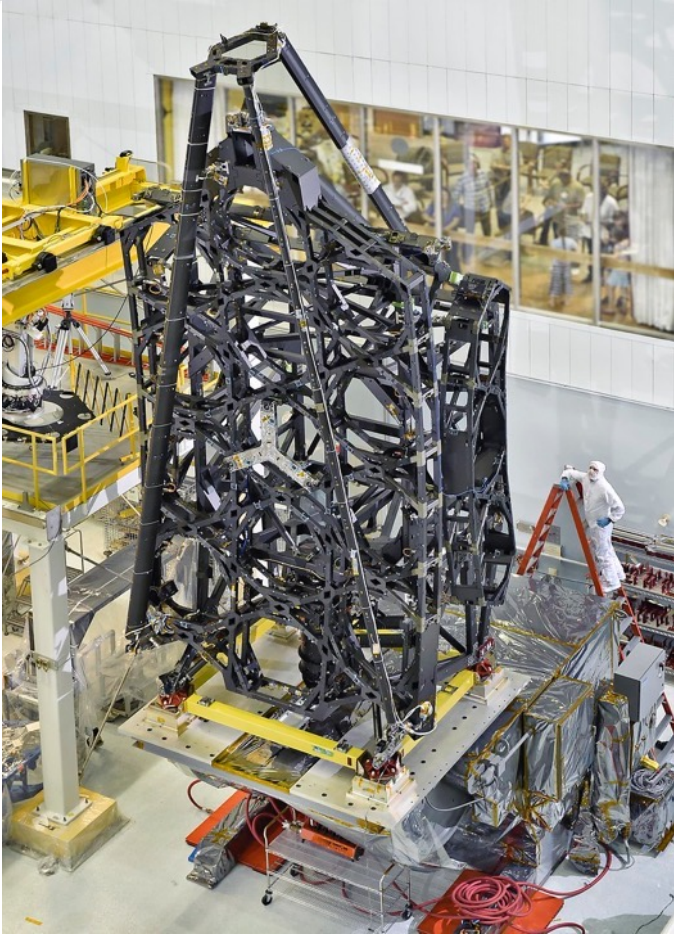




Back in Time Machine



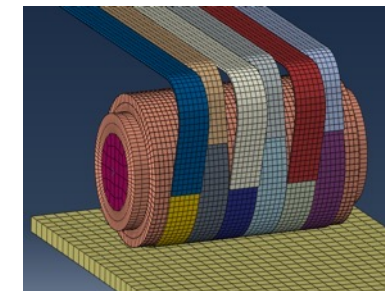
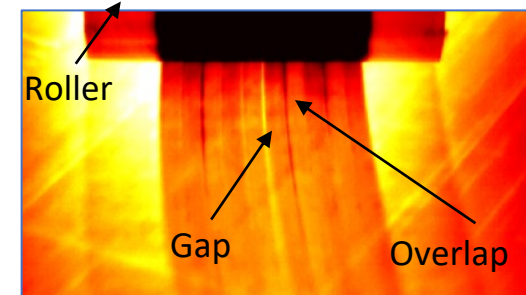
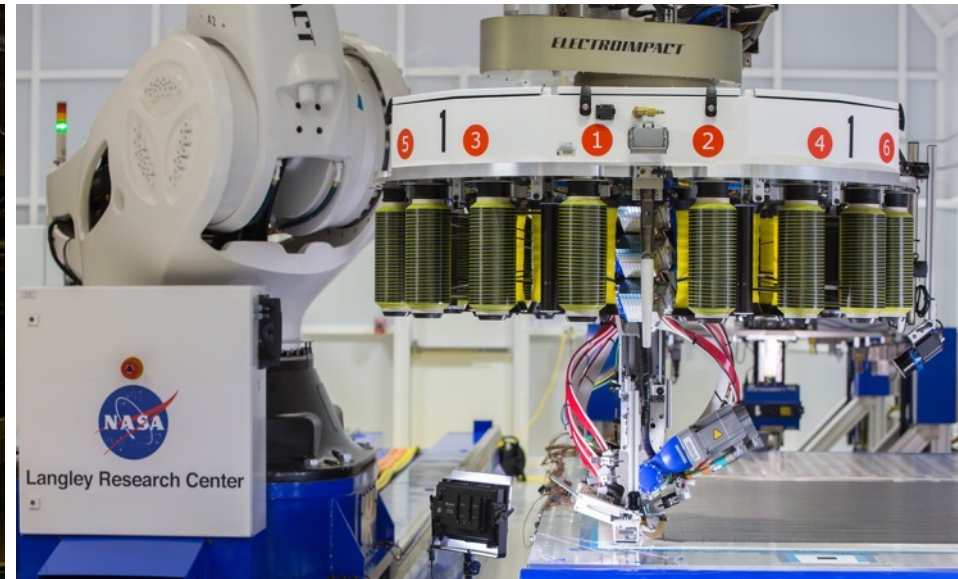
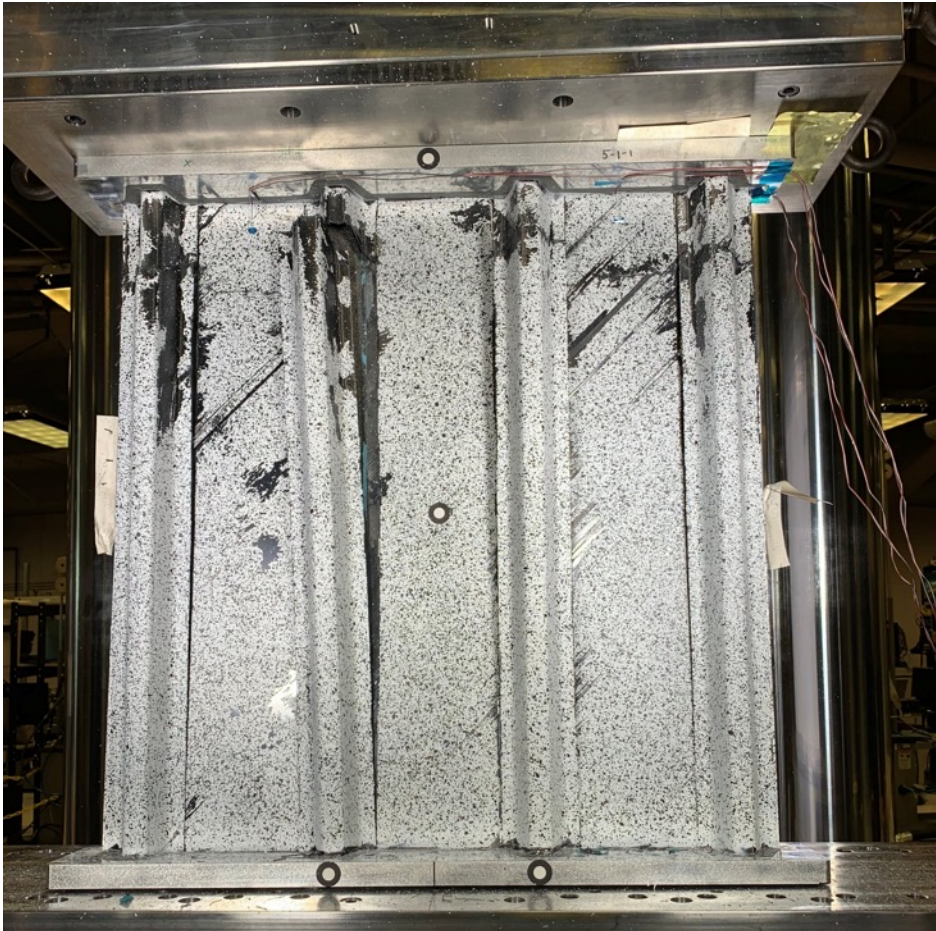
The James Webb Space Telescope's Backplane



The backplane carries more than 2400kg (2 1/2 tons) of hardware, performs at temperatures colder than -400°F (-240°C) with unprecedented thermal stability within 32 nanometers, which is 1/10,000 the diameter of a human hair!

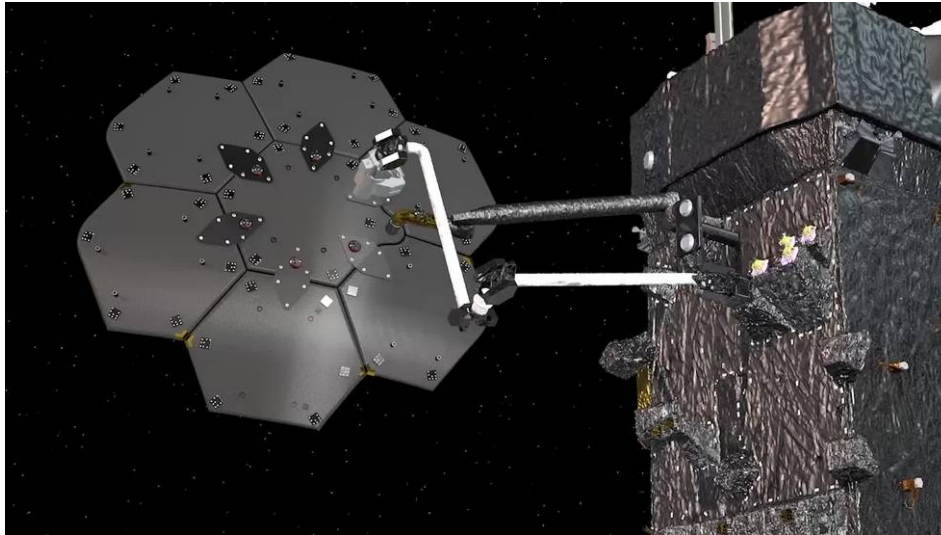


Remaining Competitive in Aircraft Manufacturing

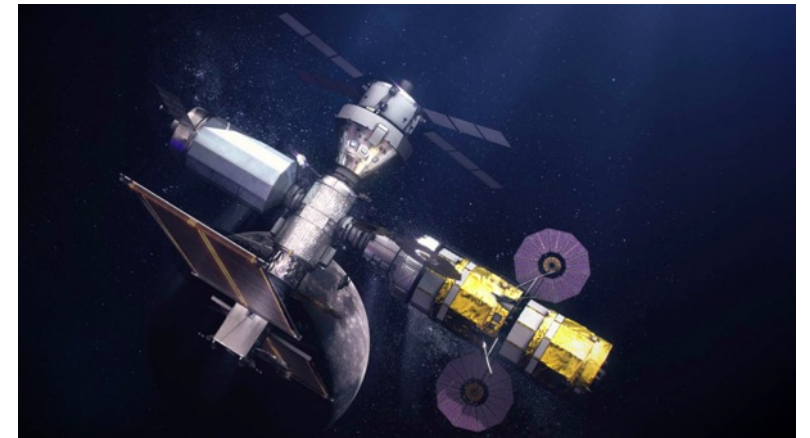


Advanced Composites Project completed after a 5 year research effort and \$170M investment
Hi-Rate Composite Aircraft Manufacturing (HiCAM) (in formulation in FY21)
Reducing time to develop & certify composite structures
Partnerships between government, industry and academia

In-Space Manufacturing



Human Exploration and Operations





Over 20 Years of NASA Investments in Composites for Exploration



Northrop Grumman SLS advanced booster tank



Northrop Grumman tank tested at MSFC



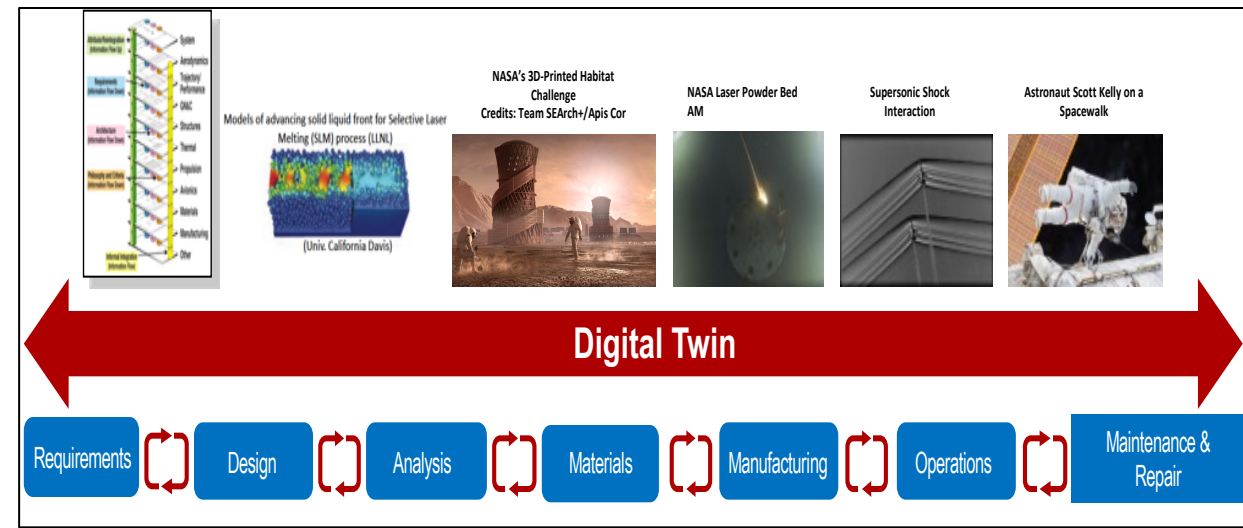
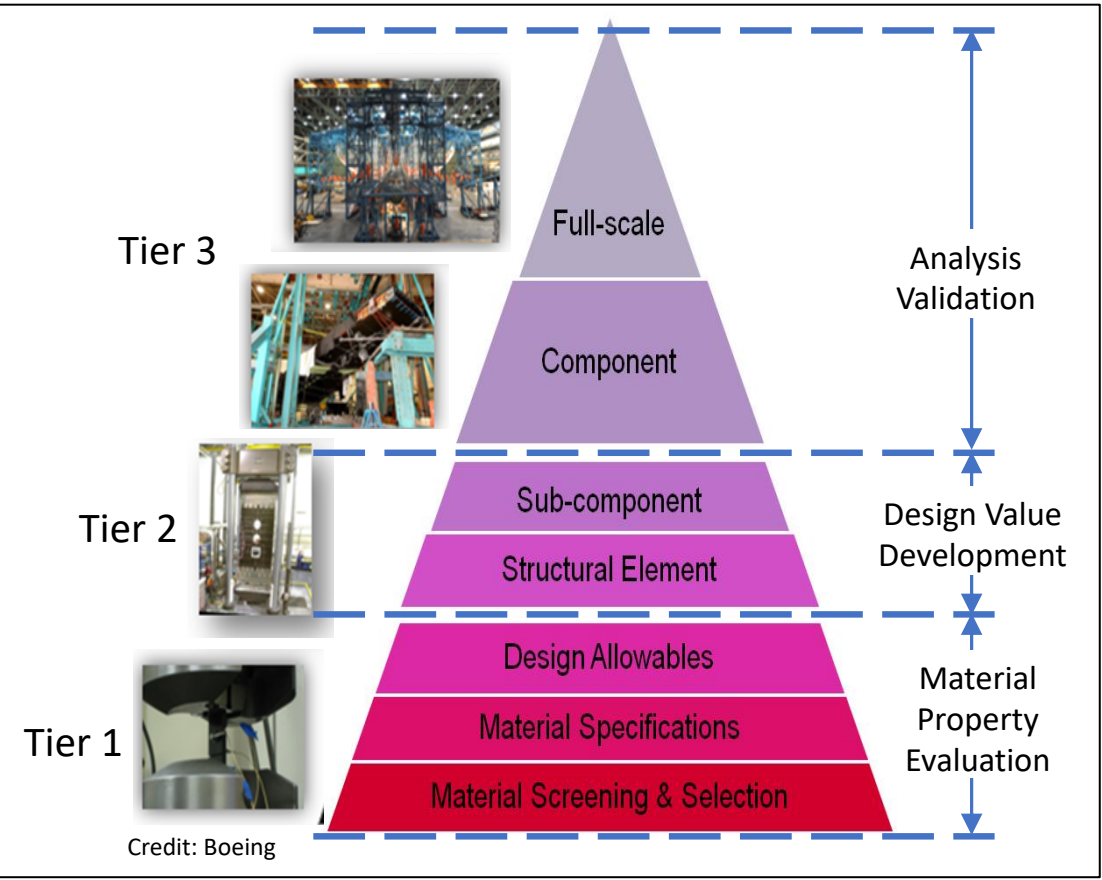
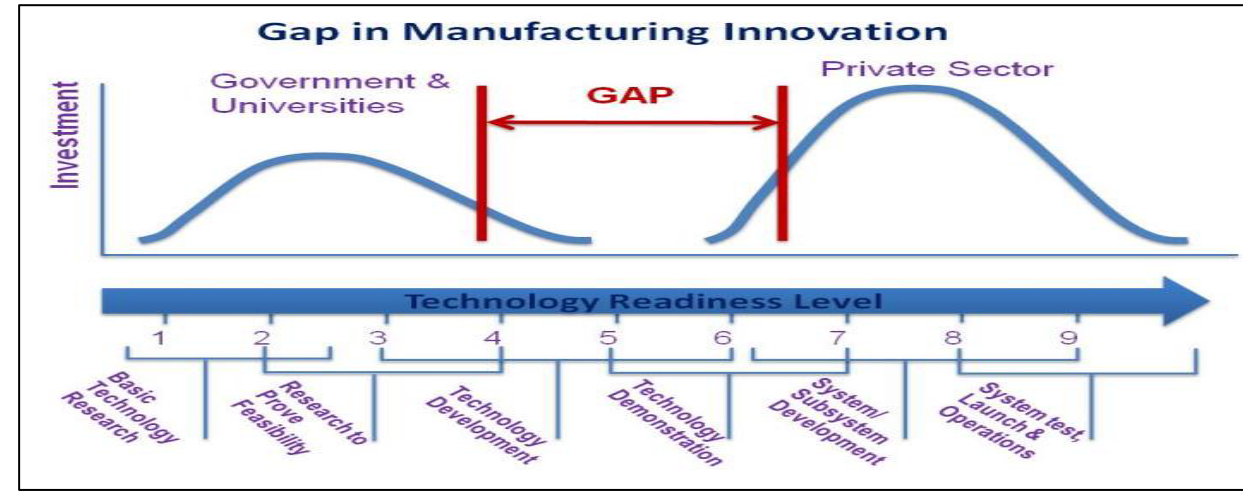
Composite Crew Module



Boeing / NASA composite cryotank tested at MSFC



Digital Twin! “A Little Less Conversation A Lot More Action Please”



Product Development, Testing and Certification Today - Exhaustive testing done to support analysis
“It takes too long and costs too much to certify aerospace structures”



Space Technology Research Grants and STEM



NASA Space Technology Graduate Research Opportunities (NSTGRO)

- Graduate student research in space technology; research conducted on campuses and at NASA Centers and not-for-profit R&D labs

Early Career Faculty (ECF)

- Focused on supporting outstanding faculty researchers early in their careers as they conduct space technology research of high priority to NASA's Mission Directorates

Early Stage Innovations (ESI)

- University-led, possibly multiple investigator, efforts on early-stage space technology research of high priority to NASA's Mission Directorates
- Paid teaming with other universities, industry, and non-profits permitted

Lunar Surface Technology Research (LuSTR) Opportunities

- University-led efforts addressing high priority lunar surface challenges
- Short duration, high value grants with emphasis on potential infusion
- Paid teaming with other universities, industry, and non-profits encouraged

Space Technology Research Institutes (STRI)

- University-led, integrated, multidisciplinary teams focused on high-priority early-stage space technology research for several years





Lessons Learned



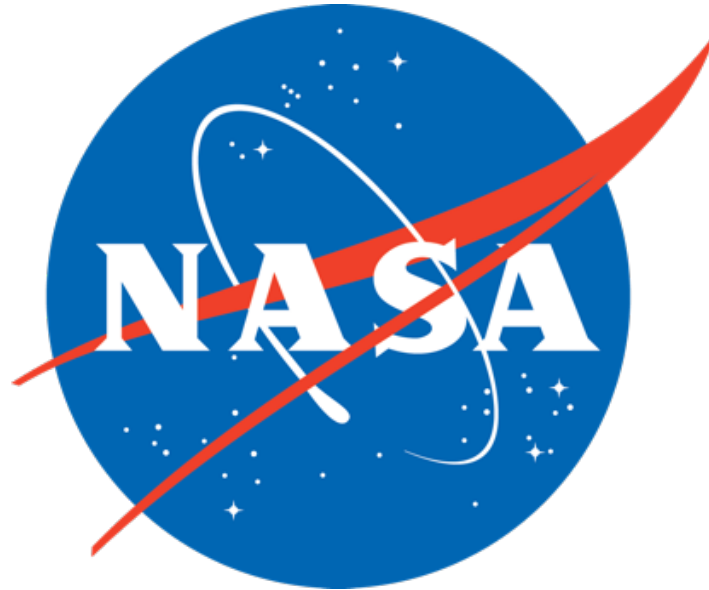
Vision comes from thinking about what forces are at play in the endeavor - Simulation is the language for innovation... Byron Pipes

Composites in space applications provide an avenue to align with, accelerate, and better prepare the industrial base for future participation... Les Cohen

The quest for improved materials for aerospace vehicles is never ending... Mark Shuart

Composites need to be less about the exotic and more about the conventional, met with good science and engineering to mitigate the risks and dispel the concern... Chris Crumbly

Do big things! – For the love of the game... John Vickers



Thank You

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